R E P O R T R E S U M E S

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DATA PROCESSING, LABORATORY PROCEDURES AND THEORY, COURSE OF STUDY.

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DESCRIPTORS- *CURRICULUM GUIDES, *CURRICULUM, *BUSINESS EDUCATION, *DATA PROCESSING, HIGH SCHOOLS, POST SECONDARY EDUCATION,

DESIGNED FOR TEACHER USE, AN OUTLINE OF UNITS FOR A COURSE OF STUDY IN DATA PROCESSING FOR GRADES 9, 10, 11, AND 12 IS PRESENTED. THE PROGRAM IS DESIGNED FOR THE STUDENT WHO WISHES TO MAKE A CAREER OF DATA PROCESSING. THE PROGRAM CAN BE ADAPTED TO THE STUDENT WHO WISHES TO ENTER INDUSTRY IMMEDIATELY UPON GRADUATION OR TO THE ONE WHO WISHES TO HAVE NECESSARY COLLEGE ENTRANCE REQUIREMENT FOR CONTINUING HIS EDUCATION. SKILLS TO BE DEVELOPED INCLUDE THE OPERATION OF TABULATING EQUIPMENT AND ELECTRONIC COMPUTERS. COMPUTER CONCEPTS AND PROGRAMING ARE CENTERED AROUND THE IBM 1401. THE MATERIAL WAS DEVELOPED BY LOCAL AND COUNTY DATA PROCESSING INSTRUCTORS AND TESTED THROUGH CLASSROOM USE. UNIT OUTLINES ARE INCLUDED FOR THE FOLLOWING EQUIPMENT -- IBM 026, 082, 548, 514, 085, 402, 1401, 1311, 1402, 1403, AND THE PHILCO CORPORATION BINARY NUMBER TRAINER. OTHER COURSES NECESSARY TO THE STUDENT SUCH AS SCIENCE, MATHEMATICS, AND BOOKKEEPING ARE NOT LISTED. A BIBLIOGRAPHY OF PUBLICATIONS AND SOURCES OF AUDIOVISUAL AIDS ARE INCLUDED. THIS DOCUMENT IS AVAILABLE FOR $1.00 FROM VOCATIONAL-TECHNICAL CURRICULUM LABORATORY, 10 SEMINARY PLACE, RUTGERS UNIVERSITY, NEW BRUNSWICK, NEW JERSEY 08903. (FS)

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State of New Jersey
Department of Education
Division of Vocational Education

COURSE OF STUDY

DATA PROCESSING

LABORATORY PROCEDURES AND THEORY

VT003165

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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State of New Jersey
Department of Education
Division of Vocational Education

Course of Study

DATA PROCESSING

Laboratory Procedures and Theory

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INTRODUCTION

The course of study contained herein is limited to the subject of data processing itself. The course is also limited, in a sense, by the equipment configuration available. For example, computer concepts and programming are centered around the IBM 1401 because this is the system installed at Burlington County Vocational-Technical High School.

The use of unit lessons provides for sufficient flexibility to update or change the course as the needs of the student and the data processing industry change. Another school wishing to follow this outline need only follow the suggested sequence, dropping out those units which do not fit into a particular school's equipment configuration.

It should be borne in mind that the units presented are logical units. Some can be handled in a brief period, others will demand more time. There is no set time allotted for each unit.

It is expected that an instructor will schedule sufficient practice problem work to provide reinforcement as well as to evaluate the student's progress.

This course is designed for the student who wishes to make a career of data processing, with or without further higher education. For this reason, the content of the course is extensive. The philosophy of Burlington

County Vocational-Technical High School is to present to the student an opportunity to learn as much as possible, with the thought that it is better to challenge the student to aim high, rather than to merely permit him to be satisfied with acquiring only the basics needed for initial employment.

DATA PROCESSING

Job Description

Data Processing, a relatively new technology, is the application of advanced techniques to the old problems of counting, classifying, and interpreting numbers, names, and other bits of information collectively known as data.

Early man probably counted his sheep being sent out to pasture by placing stone upon stone as his animals passed by a particular spot. When they returned, he took the stones from the pile. If there were stones remaining, sheep were missing and something had to be done. This man had precise, specific information as to a problem. From this he could determine a course of action - namely, go out and find the missing sheep.

Today the modern business man sends out his statements and notices of payment due. He totals the returned payments. If all are not in, money is missing from the company and something has to be done. This man has precise, specific information as to a problem. From this he can initiate a course of action.

The problems of these two persons are basic. They differ only in size, amount, and complexity.

Today's businesses and industries employ up-to-date electro-mechanical and electronic equipment to process their data.

Contrary to popular opinion, this equipment (data processing machines) does not think for itself - in fact, it does not think at all. Solutions to problems, sorted data, and tabulated statements are the result of a trained person's thinking processes. His thoughts are translated to the machines by means of wires in plug-boards, special internally sorted verbal patterns, or other methods.

Data processing machines such as electronic computers, accounting machines, and sorters perform simple repetitive operations in a specialized sequence - determined in advance by the data processing personnel responsible for the operation. Setting up the operations and providing the proper sequence (giving the machine instructions) is known as programming.

An examination of what is needed to provide these instructions leads to the following requirements of a data processor:

1. He (or she) must be able to think logically. Machines do not make errors. The people who program and use them, do.

2. He must have the ability to analyze a problem and arrive at a method of solution.

3. He must be knowledgeable in many areas since data processing is used in so many fields. A knowledge of the situation and environments in which a problem exists is essential. (For example, to solve an accounting problem, a knowledge of accounting is required.)

4. He must have a knowledge of data processing equipment and techniques. These machines and techniques are the tools of his trade. His

knowledge must be both general and applicable to all machines as well as specific and pertaining to the machine with which he is actually working.

5. The data processor must have the ability to communicate. He will be communicating with the people who supply the information and data which serves as raw material to be processed. He may have to interpret and explain machine output to his co-workers or management. Most important, he must communicate with the machines with which he is working.

6. He must have the ability to use mathematics, one of the basic tools of the data processor.

In summation, the data processor must be a thinking man with a knowledgeable background in many fields. His dexterity must be more mental than manual. He must be capable of handling many details without becoming so enmeshed in them that he loses sight of the desired outcome.

The types of positions in the field of data processing are numerous. Entry positions include tabulating machine operator, wireman, and computer programmer trainee.

One point is paramount. Most companies hire people who are capable of advancement in this field. Many job opportunities exist for the person skilled in the fundamentals and capable of profiting by on-the-job training and further education.

Course Description

The Data Processing course emphasizes the basic skills and knowledge needed for the student to either enter the Data Processing field immediately upon graduation or to continue his education if desired.

His skills will include the operation of tabulating equipment and electronic computers. He will be able to set up his job, program it, and see it through the machine to completion.

More important, basic concepts are taught which are applicable to all types of data processing equipment, enabling the student to be flexible and to keep pace with the changes in the industry.

The diligent student will emerge from the course with a mind trained in the processes of job analysis and the ability to think in a logical manner, for these are the marketable skills that industry is seeking of data processors.

The content of the course is so organized as to constantly present the student with practice problems which are equipment oriented. The student learns by doing.

Other courses necessary to the student such as science, mathematics and bookkeeping are handled by separate departments. Each department, however, is in constant contact with the others, working closely to keep all course content up to date and pertinent to the student's courses in data processing.

At the completion of tenth grade, the student, in consultation with his instructor and counselor will enter either the vocational or technical program.

The vocational program is primarily intended for the student who wishes to enter industry immediately upon graduation. The technical program is scheduled in such a manner that if the student wishes to continue his education, he will have the necessary college entrance requirements. A graduate of either course is sufficiently trained to take an entry position in the field of data processing.

Equipment and Facilities

Burlington County Vocational and Technical High School has a modern, well equipped data processing laboratory.

Equipment includes:

2 IBM 026 Keypunches

IBM 082 Sorter

IBM 548 Interpreter

IBM 514 Reproducing Punch (with mark sensing feature)

IBM 085 Collator

IBM 402 Accounting Machine (with Summary Punch feature.)

IBM 1401 Computer with 8K memory, multiply, divide, and advanced programming features.

IBM 1311 Disc Storage Unit

IBM 1402 Card Read/Punch Unit

IBM 1403 Printer

Philco Corp. Binary Number Trainer

The school also has additional analog computer equipment, as well as several Keltec Computer Tutors.

COURSE OF STUDY OUTLINE

Data Processing
Grade 9

Exploratory — Six Weeks-67.5 hours

Purpose and Philosophy

The exploratory program has a two-fold purpose. First, the student is introduced to the field of data processing. Second, the instructors have a chance to evaluate the student. The student's exploration and instructors' evaluation should lead to grades 10, 11, and 12 students who wish to make data processing their career, and who have the capabilities to succeed in their chosen field.

It should be kept in mind that many students who will not choose data processing after completing the exploratory course will still benefit from knowledge obtained here and should be able to apply some concepts and techniques to other fields of endeavor.

It is imperative that the students begin machine operation and board wiring as soon as possible. This is stressed because, by its nature, data processing is highly theoretical and conceptual, and most ninth graders must "see some action" and also "be doing something". The instructor should keep in mind that the nature of the course is exploratory and that most theory can be introduced in the later grades. This does not preclude, however, challenging the student to do some creative thinking on his own.

The suggested sequence for the exploratory program is :

1. A general overview of the program.

2. A discussion of the installation safety procedures and other practices.

3. Machine Demonstrations

4. The following units:

151E	156E	161E	166E
152E	157E	162E	167E
153E	158E	163E	168E
154E	159E	164E	169E
155E	160E	165E	

COURSE OF STUDY OUTLINE

Data Processing
Grade 10

Objectives:

1. To introduce the student to the basic operations and programming of unit record tabulating equipment.
2. To introduce basic computer operation and organization.
3. To inculcate in the student the habits of good workmanship and data processing installation practice.
4. To provide a sound basis for the student's decision (in consultation with his instructor and counsellor) to enter either the vocational or technical track.

Suggested Sequence:

Orientation

Overview

Units	1G	5G	9	13	17
	2	6	10	14	18
	3	7	11	15	19
	4	8	12C	16	20

Optional Units 21, 22

G Units are units common to tabulating and computer.

C Units are units applicable to computers.

Units not followed by a letter designation are tabulating units.

Note: For those students who have not had Grade 9 Data Processing (Exploratory) it is suggested that the Units 151E, 169E be given before starting with the above.

GRADES 11 AND 12 PROGRAM ORGANIZATION

The Grade 11 & 12 Technical Program is organized in such manner that the student is immediately introduced to computer work while continuing into advanced unit record work.

The suggested weekly sequence is four days of computer work and one day of unit record work.

An advantage to this type of program is that the student is never away from unit record equipment and if he seeks employment immediately upon graduation, he is capable of taking an entry position in a tabulating department.

The Grade 11 & 12 Vocational Program is set up to provide strong background and practice work on unit record tabulating equipment. Operator procedures and skills are emphasized. At the same time the student is introduced to computer operation and basic programming. This provides a background for later advancement in industry from a tabulating department to a computer installation.

The suggested weekly sequence is four days of unit record work and one day of computer training.

COURSE OF STUDY OUTLINE

Data Processing
Grade 11 - Vocational

Objectives:

1. To increase the student's knowledge of unit record tabulating equipment.
2. To emphasize operator skills.
3. To provide the student with adequate practice problem opportunities in unit record work.
4. To further advance the student in computer concepts and operation.

Suggested Sequence:

Orientation

Overview

Tabulating Sequence - (4 days per week)

201	30	40	42	49	56	63G	70	77
21	28	35	43	50	57	64	71	
22	29	36	44	51	58	65	72	
23	31	37	45	52	59	66	73	
24	32	38	46	53	60	67	74	
25	33	39	47	54	61	68	75	
26	34	41	48	55	62	69	76	

Computer Sequence - (1 day per week)

83C	85C
a	86C
d	87C
e	88C
f	89C
84C	90C

COURSE OF STUDY OUTLINE

Data Processing
Grade 11 - Technical

Objective:

1. To develop in the student basic proficiency in the skills of computer operation and programming.
2. To continue the student's education in the field of unit record tabulating equipment.
3. To show relationships between tabulating and computer systems.

Suggested Sequence:

Orientation

Overview

Tabulating Sequence - (1 day per week)

21	26	31	42	51	56	62
22	27	35	47	52	58	63G
23	28	36	48	53	59	64
24	29	38	49	54	60	65
25	30	39	50	55	61	

Computer Sequence - (4 days per week)

83C	90C	97C	105C	111C	118C
84C	91C	98C	106C	112C	119C
85C	92C	99C	107C	113C	121C
86C	93C	100C	108C	114C	122C
87C	94C	101C	109C	115C	123C
88C	95C	103C	120C	116C	
89C	96C	104C	110C	117C	

COURSE OF STUDY OUTLINE

Data Processing
Grade 12 - Vocational

Objectives:

1. To increase the student's proficiency in wiring and operating unit record tabulating equipment.
2. To broaden the student's concept of data processing applications.
3. To provide additional computer training so that the student can write elementary programs.

Suggested Sequence:

Orientation

Overview

Tabulating Sequence - (4 days per week)

58	63G	68	73	78
59	64	69	74	82
60	65	70	75	79*
61	66	71	76	80*
62	67	72	77	81*

Computer Sequence - (1 day per week)

91C	96C	101C*
92C	97C	103C*
93C	98C	104C*
94C	99C	147C*
95C	100C	207*

*These units are optional and should not be scheduled until required units have been completed.

COURSE OF STUDY OUTLINE

Data Processing
Grade 12 - Technical

Objective:

1. To increase the student's proficiency in some of the more advanced types of business computer programming.
2. To continue the student's work in the field of unit record tabulating equipment.
3. To introduce the student to scientific programming concepts and language.
4. To introduce the student to some of the more advanced computer usages including operating systems and telecommunication techniques.

Suggested Sequence:

Orientation

Overview

Tabulating Sequence - (1 day per week)

66	72	208
67	76	82*
69	78	81*
70		

Computer Sequence - (4 days per week)

207†	127C	130C	135C	139C	144C
124C	128C	131C	136C	140C	145C
125C	129C	132C	137C	141C	146C
126C	205C	133C	138C	142C	206
	147C	134C		143C	203C*
					204C*

* Optional Units
† The contents of this unit are to be taught in sequence throughout the year.

UNIT NUMBER TITLES

Unit Number	Unit Title
1G	The Punch Card
2	Keypunch, Introductory
3	402 Concepts, Introductory
4	402 Operation, Introductory
5G	Use of Reference Manuals
6	Sorter (082) Concepts and Operation
7	Interpreter (548) Concepts and Operation, Introductory
8	Reproduced (514) Concepts and Operation, Introductory
9	Collator (085) Concepts and Operation, Introductory
10	Addition on 402
11G	Flow Charts and Block Diagrams
12C	Computer Operation (1401), Introductory
13	X-Brushes and X-Control
14	Selection on Interpreter
15	Selection on Reproducer
16	Selection on 402 (Introductory)
17	Interpreter (548) Concepts, Advanced

NOTE: Those units followed by G are general units
C are computer units
E are exploratory units
Blank are unit record units

Unit Number	Unit Title
18	Program Control, 402
19	Subtraction, 402, Net Balance
20	Counter Exit Suppress, 402
21	Card Count, 402
22	Offset Total Printing, 402
23	Column Split, 402
24	Digit Select, 402
25	Gangpunching (514), Advanced
26	Reproducing (514), Advanced
27	Comparison (514)
28	Additional Features 514 Reproducer
29	Hammerlock Control, 402
30	Group Indication, 402
31	Mark Sensing (514 Reproducer)
32	Total Transfer, Net Balance 402
33	Subtraction, Non-Net Balance 402
34	Total Transfer, Non-Net Balance 402
35	Space and Print Control (402)
36	Crossfooting, Net Balance (402)
37	Crossfooting, Non-Net Balance (402)
38	Zone Suppress (402)
39	Totals Spacing and Printing (402)
40	Total Printing From Different Type Type Bars (402)
41	Program Exit Expansion (402)
42	Split Column Control (402)

NOTE: Any number without a unit title indicates a vacant place for a future unit to be added with the acquisition of new equipment or modification of present equipment.

Unit Number	Unit Title
43	Total Program Couple (402)
44	First Card Spacing (402)
45	Expanding Program Exits (402)
46	Forms Layout and Design
47	Control Tape, 402 (Physical Preparation)
48	Carriage Control Operating Features (402)
49	Set Up Change (402)
50	Multiple X Selection (402)
51	Machine Stop (402)
52	Negative Balance Recognition (402)
53	Summary Punching (514 & 402)
54	Progressive Total Printing (402)
55	Paper Tape (402 Carriage), Advanced Operations
56	Form Control 402
57	403 (IBM) and MLP Survey
58	Collator (085) Concepts and Operation, Advanced
59	Merge, Unpunched Cards (085)
60	X-Card Selection, One Feed (085)
61	X-Card Selection, Both Feeds (085)
62	Blank Column Detection (085)
63G	Numerical Sequence Concepts
64	Sequence Check Ascending (085)
65	Sequence Check Descending (085)
66	Use of Indicator Cards (085)
67	Change in Control Groups (085)

Unit Number	Unit Table
68	Selecting Alternate Cards (085)
69	Multiple or Single Card Group Selection (085)
70	Zero Balance Selection (085)
71	Typical Sequence and Selection Operations (085)
72	Merging (No Basic Set Up) (085)
73	Merging with Basic Set Up (085)
74	Summary of Basic Set Up (085)
75	Typical Merge Operations (085)
76	Matching (085)
77	Optional Features, Collator
78	Applications Study 1, Payroll and Labor Accounting
79	Applications Study 2, Accounts Payable
80	Applications Study 3, Accounts Receivable
81	Applications Study 4, General Ledger and Financial Control
82	Applications Study 5, Inventory Control and Material Accounting
83C	Number Systems for Computers
84C	Introduction to Computer Programming
85C	Flow Chart of Computer Program
86C	S.P.S. Coding Sheet, (1401)

Unit Number	Unit Title
87C	Reserved Areas in 1401
88C	Character Layout (1401)
89C	Elementary Commands/Operation Codes (1401)
90C	Writing Simple Programs (1401)
91C	Computer Operator Orientation (1401)
92C	Card Reader Operation (1402)
93C	Card Punch Operation (1402)
94C	Printer Operation (1403)
95C	C.P.U. Operations (1401)
96C	Assembly Routine (Card Only) 1401
97C	Dumping (1401)
98C	Console Error Sheet (1401)
99C	Disc Operation and Controls (1311)
100C	Programming Concepts, Intermediate
101C	The Branch Instruction (1401)
102	
103C	Overview of Computer Applications
104C	Symbolic Coding of Constants
105C	Processor Control Operations 1401
106C	Condensing Programs
107C	Commands/Operation Codes-Intermediate 1
108C	Commands/Operation Codes-Intermediate 2
109C	Editing
110C	Combined Instructions
111C	Document Control
112C	Character Adjustments

Unit Number	Unit Title
113C	Index Registers
114C	Address Modification
115C	Multiply Subroutine
116C	Multiply Feature
117C	Divide Subroutine
118C	Divide Feature
119C	Square Root Subroutine
120C	Expanded Print Edit
121C	Rounding Results in Computer
122C	Command/Operation Codes, Advanced
123C	Disc (1311) Programming, Elementary
124C	Concepts of Automatic Programming Language
125C	Introduction to Autocoder
126C	Autocoder Operands
127C	Autocoder Literals
128C	Autocoder Language
129C	Macro Statements (Autocoder)
130C	Selected Practice Problem, Autocoder (1401)
131C	FORTRAN Programming, Introduction
132C	Fortran Constants
133C	Fortran Variables
134C	Fortran Operations and Expressions
135C	Fortran Mathematical Functions
136C	Fortran Assignment Statements
137C	Fortran Input and Output

Unit Number	Unit Title
138C	Other Fortran Statements
139C	Writing, Punching & Running a Fortran Program
140C	Fortran Case Study #1, Area of Triangle
141C	Transfer of Control in Fortran
142C	Fortran Case Study #2, Current in AC Circuit
143C	Subscripted Variable
144C	Fortran Case Study #3, Linear Interpolation
145C	Fortran DO Statement
146C	Fortran Case Study #4, Gaus-Seidel Method for Solving Simultaneous Equations
147C	Operating Systems Survey
148	
149	
150	
151E	Concept of Programming
152E	Punched Card (IBM-80 Col.)
153C	Keypunch
154E	IBM 402 Part 1
155E	LBM 402 Part 2
156E	IBM 402 Part 3
157E	IBM 402 Part 4
158E	Flowcharts and Block Diagrams
1591E	IBM Sorter Part 1
1601E	IBM Sorter Part 2

Unit Number	Unit Title
161E	IBM 548 Interpreter
1621E	IBM 514 Reproducer Part 1
1631E	IBM 514 Reproducer Part 2
1641E	IBM 514 Reproducer Part 3
1651E	IBM 514 Reproducer Part 4
1661E	IBM 085 Collator
1671E	Computers - Part 1
168E	Computers - Part 2
169E	Survey Data Processing Field
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Unit Number	Unit Title
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201	Keypunch Techniques, Advanced
202	
203C	Introduction to COBOL
204C	Introduction to Tape Programming and Operation
205C	I.O.C.S. Programming
206C	Advanced Input/Output Configurations
207	Logic

Unit Descriptions

Unit 1 The Punch Card

a. Columns and Rows
b. Corner Cut
c. The Hollerith Code
d. Error Correction (K.P. Correction Seals)
e. Card Handling
f. Concept of Field

Unit 2 Introductory Keypunch

a. Card Travel and Loading, Column Indicator
b. Keyboard, Alphabetical and Numerical
c. Special Characters
d. Special Operations
   (1) Backspace
   (2) Card Jams
   (3) Fuses
   (4) Chips

Unit 3* Introductory 402 Concepts

a. Board and Wiring Diagram
b. Concept of Programming-Entry Hubs and Exit Hubs
c. Entry Hubs and Exit Hubs
d. Division of typebars
e. Zone Reading } CARD FLOW THROUGH MACHINE
f. Number Reading }
g. List All-Detail Printing
h. Number Printing-Straight
i. Number Printing-Offset
j. Alphabetical Printing-Straight
k. Alphabetical Printing-Offset
l. Combined Alphabetical and Numerical Printing
m. Concept of Emitting
n. Number Emitting & Printing on 402
o. Zone Emitting
p. Alphabetic Emitting & Printing on 402
q. Card Count E
r. Bus Hubs

Unit 4 Introductory 402 Operation

a. Wire Handling
b. Board Insertion and Extraction

*Units 3 and 4 are to be taught as combined units-mix as needed.

c. Split Wiring
d. Operating Lights Keys and Buttons
   (1) Start
   (2) Stop
   (3) Final Total (for later use)
   (4) Idle
   (5) Fuse
   (6) Form
   (7) Card Feed Stop (for later uses)
   (8) Non-Print Run Out Button
   (9) Feed Interlock Start Button
   (10) Gang Punch Toggle (for later use)
   (11) Last Card Auto Total Toggle (for later use)
   (12) Set Up Change Toggles (for later use)
e. Zero Suppression with Hammer Split Levers
f. Carriage Control Space Button
g. Changing Paper on 402 Carriage
h. Changing Ribbon on 402

N.B. It is not necessary to explain the functions of those keys, toggles etc. marked for later use. It is sufficient to point out their location.

Unit 5 Use of Reference Manuals

a. Why
b. When
c. How

Unit 6 IBM 082 Sorter, Operation and Concepts

a. Need for Sorting
b. Card Flow Through Sorter
c. Controls and Switches
   (1) Main Line (Fuse Replacement)
   (2) Start
   (3) Stop
   (4) Column Indicator
   (5) Pockets (pocket stop)
   (6) Selection Switches
   (7) Chute Blades
   (8) Hand Feed Wheel
d. Operating Procedures
e. Numerical Sorting
   (1) Single digit
   (2) One Field
f. Alphabetic Sorting
   (1) Single Character
   (2) One Field
g. Sorting More Than One Field (Numeric)
   (1) Concept of Major, Intermediate, Minor

h. Sorting More Than One Field (Alphabetic)
i. Block Sorting
j. Sequence of Sorting for Reports
k. Single Column Selection
l. Short Cut for Alpha Sort
m. Removing Card Jams
n. Replacing Brush
o. Timing Brush
p. Card Checking
    (1) Sight
    (2) Needle

Unit 7 Interpreter (548) Concepts and Operation, Introductory

a. Need for Interpreting
b. Card Flow Through Interpreter
c. Controls and Switches
    (1) Main Line
    (2) Start
    (3) Stop
    (4) Printing Position Knob
d. Operation
e. Wiring for Interpreting

Unit 8 Reproducer (514) Concepts and Operations, Introductory

a. Need for Reproducer
b. Definition of Reproducing
c. Definition of Gangpunching
d. Card Flow Through Reproducer
e. Controls and Switches for Reproducing and Gangpunching
    (1) Main Line
    (2) Start
    (3) Stop
    (4) Switch Setting for Reproducing
    (5) Control Panel Wiring For Gangpunching
    (6) Control Panel Wiring For Straight Reproducing
    (7) Control Panel Wiring For Offset Reproducing
    (8) Wiring for Combined Gangpunch and Reproducing

Unit 9 Collator (085) Concepts and Operation, Introductory

a. Merging
    (1) Need for
    (2) Definition of
    (3) Controls
        (a) Main Line
        (b) Start
        (c) Stop
        (d) Run out

b. Board Wiring-Merge Unpunched Cards
c. Use of Template Overlay for Board Interchange

Unit 10 Addition on IBM 402

a. Concept of Counters
b. Review-Concept of Carry
c. Counter Entry Hubs
d. Counter Exit Hubs
e. Card Cycles Hub
f. Counter Total Hub
g. Final Total Hub
h. Asterisk Symbol Emitting for Final Total
i. Group Printing-Final Total Only

Unit 11G Flow Charts-Block Diagrams

a. Need For
b. Basic Symbols
c. Using Flow Charts and Block Diagrams

Unit 12C Introduction to Computer Operation

a. Logical Parts of Computer
   (1) Arithmetic
   (2) Memory
   (3) Control
   (4) Input/Output
b. Controls
   (1) Main Line
   (2) Emergency Off
   (3) Start
   (4) Stop
   (5) Reset
   (6) Runout-Punch, Read
c. Card Load
d. Printer Space
e. Job Logging
f. Job Running

Unit 13 X-Brushes and X-Control

a. Concept of X control
b. Concept of Selection
c. Location of X Brushes on
   Interpreter
   Reproducer
d. Explanation of X Pick up on
   402
   Collator

Unit 14 Selection on Interpreter

a. Selector Pick Up
b. Concepts of
   (1) Common
   (2) Normal
   (3) Transfer
c. Concept of
   (1) Field Selection
   (2) Class Selection
d. Wiring for
   (1) Field Selection
   (2) Class Selection

Unit 15 Selection on Reproducer

a. Switch Setting for Field Selected Reproducing
b. Wiring for Field Selected Reproducing

Unit 16 Selection on 402 (Introductory)

a. Pilot Selectors
b. X Pick Up of Pilot Selectors
c. Selective Printing
d. Wiring Selective Printing
e. Co-Selectors and IPU
f. Wiring for Field Selection (Numeric)
g. Wiring for Class Selection (Numeric)

Unit 17 Interpreter (548) Concepts, Advanced

a. X-Elimination
   (1) Need for
   (2) Control Panel Wiring
b. Zero Elimination
c. Review IBM 552 Interpreter

Unit 18 Program Control - IBM 402

a. Need for
b. Description of
   (1) Minor, Intermediate, Major Relationships
c. Comparing Unit
d. Program Start
e. Total Program Start
f. Wiring for Program Control

Unit 19 Subtraction - IBM 402 Net Balance

a. Concept of Complementary Arithmetic
   (1) Tens Complement
   (2) Nines Complement
b. Net Balance Subtraction
   (1) Review Pilot Selector
   (2) Counter Control Minus
   (3) Carry Exit-Carry Entry
   (4) Negative Balance Test Exit
   (5) Negative Balance Control
c. CR Symbol Exit

Unit 20 Counter Exit Suppression - IBM 402

a. Need for
b. Wiring and Use

Unit 21 Card Count - IBM 402

a. Need for
b. Wiring and Use

Unit 22 Offset Total Printing - IBM 402

a. Need for
b. Wiring and Use

Unit 23 Column Split - IBM 402

a. Need for
b. Wiring and Use

Unit 24 Digit Selection - IBM 402

a. Review X Selection
b. Need for and Use of Digit Selection
c. DI (Digit Impulse)
d. Selective Printing, Digit Select
e. Class Selection, Digit Select
f. Field Selection, Digit Select

Unit 25 Gangpunching (514), Advanced

a. Review Gangpunching and Reproducing
b. P.X. BR. Hub
c. Gang p unching, Column per Column with Interspersed Master Cards

d. Testing PX Functions; Gangpunching
e. Offset Gangpunching

Unit 26 Reproducing (514), Advanced

a. R.X. Brush to P. - need for

Unit 27 Comparing (514)

a. Reproducing Comparison
b. Gangpunching Comparison

Unit 28 Additional Features

a. X-Elimination and Transfer
b. Column Split
c. G.P. Emitter
d. Set Up Change
e. Double-Punch and Blank - Column Detection

Unit 29 Hammer Lock Control, 402

Unit 30 Group Indication, 402

Unit 31 Mark Sensing 514

a. Straight Mark Sensing
b. Double Punch and Blank Column Detect

Unit 32 Total Transfer, Net Balance Machine (402)

Unit 33 Subtraction, Non-Net Balance Machine (402)

a. Transfer and S.P.X. Control, Plus and Minus
b. Different Typebars

Unit 34 Total Transfer, Non-Net Balance Machine (402)

Unit 35 Space and Print Control (402)

a. Non-Print

b. Space Control
   (1) Single
   (2) Double
   (3) Triple
   (4) Suppress
c. First Card Spacing

Unit 36 Crossfooting, Net Balance Machine (402)

a. Concept of and Uses
b. Wiring

Unit 37 Crossfooting, Non-Net Balance Machine (402)

Unit 38 Zone Suppress

a. Use with
   (1) Field Selection
   (2) Class Selection

Unit 39 Totals Spacing and Printing (402)

a. Minor Totals Spaced Below Items
b. Minor, Intermediate and Major on same line
   (1) Total Program Couple

Unit 40 Total Printing from Different Typebars (402)

Unit 41 Program Exit Expansion (402)

Unit 42 Split Column Control (402)

Unit 43 Total Program Couple (402)

Unit 44 First Card Spacing (402)

Unit 45 Expanding Program Exits (402)

Unit 46 Forms Layout and Design

a. Layout and Design
b. Relation to Paper Tape (402)

Unit 47 Control Tape (402) (Physical Preparation)

a. Tape Channel
b. Overflow and Tape Control
c. Punching Paper Tape

Unit 48 Carriage Control Operating Features

a. Inserting Paper Tape On Carriage
b. Keys and Knobs
c. Forms Feed
d. Platen
e. Adjusting Thickness
f. Brake and Stop Device
g. Tension Adjustment
h. Pressure Release Lever
i. Platen Shift

Unit 49 Set Up Change (402)

Unit 50 Multiple X Selection (402)

Unit 51 Machine Stop (402)

Unit 52 Negative Balance Recognition (402)

Unit 53 Summary Punching (514 and 402)

a. Hub Location on 514
b. 402 Wiring and Operation
   (1) Net Balance
   (2) Non-net Balance Machine
c. Elimination of Zero Balance
d. More than one Class of Total
e. Two Cards

Unit 54 Progressive Total Printing (402)

Unit 55 Paper Tape (402) Carriage, Advanced Operations

Unit 56 Form Control

a. Short Form Skipping
b. Interlock Suppress

c. Skip to - D and I
d. Head Control
e. Tape Exit
f. Overflow
g. Overflow Skipping
h. Predetermined Line Control
i. Indicate Control
j. Inverted Forms
k. Single Sheet Form Feeding

Unit 57 403 (IBM) Multiple Line Print (Survey)

a. Features
b. MLP Card
c. Card Path
d. Card Feeding (with Delay)
e. Multiple Line Printing
f. Print Selection
g. MLP Selection
h. MLP followed by Normal Cards
i. Successive Feed-MLP Selector Expansion
j. Single Card Total Elimination
k. Crossfooting with M.L.P. Selector

Unit 58 The IBM 085 Collator Concepts and Operation, Advanced

a. Need for
b. Operating Concepts
c. Definition of Basic Operations
d. Use of Analysis Chart

Unit 59 Merging Unpunched Cards (085)

a. Plug to C
b. Primary Feed
c. Secondary Feed

Unit 60 Selecting X-Cards, One Feed, (085)

a. Primary Read
b. X- Selector
c. Primary Select

Unit 61 Selecting X-Card, Both Feeds (085)

a. Secondary Read
b. Secondary Select 3 and 4

Unit 62 Blank Column Detection (085)

a. BCD 1, BCD 2
b. BCD Control
c. Direct Impulse

Unit 63 Numerical Sequence Concepts

a. Concept of
   (1) Ascending
   (2) Descending
   (3) Broken

Unit 64 Sequence Check - Ascending (085)

a. Primary Sequence Entry
b. Sequence Entry
c. Restore (PS and S)
d. Control Input
e. Sequence Entry
f. High Sequence
g. Equal Sequence
h. Low Sequence
i. Error Stop
   (reset key on controls)
j. Both Feeds

Unit 65 Sequence Check - Descending (085)

a. Standard
b. Reverse Wiring

Unit 66 Use of Indicator Cards (085)

Unit 67 Changes in Control Groups (085)

a. Selecting Last Card of Group
b. Selecting Last Card of Group of X Card
   (1) Selectors
c. Selecting First Card of Group
   (1) Cycle Delay

Unit 68 Selecting Alternate Cards (085)

Unit 69 Selecting Single or Multiple Card Groups (085)

Unit 70 Selecting Zero Balance Cards (085)

a. Selector Entry
   (1) Secondary
   (2) Primary
b. Restore, (S and P) entries and exits
c. Control Input and Selector entry
d. Low Secondary
e. Equal
f. Low Primary
g. More than 16 columns

Unit 71 Typical Sequence and Selecting Operations (085)

a. Comparing 2 Fields in Same Card, Primary Feed
b. Comparing 2 Fields in Same Card, Secondary Feed
c. Selection by Control Number
   (1) Normal
   (2) Interspersed X Finder - Primary Feed
   (3) Interspersed X Finder - Secondary Feed
   (4) Either of 2 Control Numbers
   (5) Between 2 Control Numbers
d. Checking Master and Detail Groups
e. Checking X card if Last in Group
f. Card Insertion behind Specific Groups
g. Sequence Check, Selecting All Low Cards
h. Both Feed Sequence Checking
i. First Card Group Selection - Both Feeds

Unit 72 Merging (No Basic Set Up) 085

a. One Feed at a Time
b. Both Feeds, Simultaneously
c. Merging with Selection
   (1) Single Secondaries
      (a) Interlock
   (2) Multiple Secondaries
      (b) Primary Eject

Unit 73 Merging with Basic Set Up (085)

a. One Feed at a Time (Plan 1)
   (1) BSU SEC
   (2) BSU PRI
   (3) MSS
b. Both Feeds Simultaneously (Plan 2)
   (1) Primary Change
c. Merging with Selection
   (1) Single Secondary
   (2) Multiple Secondaries

Unit 74 Summary of Basic Set Up (085)

Unit 75 Typical Merge Operations (085)

a. More than 16 columns
b. Mixed Merging
c. Small Groups Merge
d. Primary Behind Secondary Merge
e. Merging with Selection of Unmatched Primary
f. Merging by Range of Numbers

Unit 76 Matching

a. By Equal Groups
b. Card per Card
c. By Range of Numbers

Unit 77 Optional Collator Feature (Survey)

a. Alphabetic
b. Counting
c. Split Selector and Sequence Unit

Unit 78 Application Study I - Payroll and Labor Accounting

a. Source Records
    (1) Basic Payroll and Employee Records
    (2) Deductions Authorizations
    (3) Time and Attendance Records
    (4) Production time Records
b. Regular Gross Earnings
c. Overtime Earnings
d. Taxes
    (1) FICA
    (2) Federal Income
    (3) State Income
    (4) State Unemployment (Several Types of)
    (5) Federal Unemployment
    (6) Quarterly and Annual Tax Reports
e. Other Deductions
    (1) Union Dues
    (2) Insurance
    (3) Savings
        (a) Fixed
        (b) Percentage
f. Payroll Register
g. Checks and Earnings Records
h. Cash Payments
i. Control

j. Employee History Record
k. Bank Reconciliation
l. Management Reports
m. Payroll Procedures
    (1) Salary
    (2) Day or Hourly Rate
    (3) Exception Payroll
    (4) Incentive
        (a) Group
        (b) Individual
n. Labor Accounting
    (1) Labor Distribution
    (2) Direct Labor Charges
    (3) Indirect Labor Charges

Unit 79 Application Study 2 - Accounts Payable

a. Processing Disbursements Data
    (1) Establishing Liability
    (2) Validating Liability
    (3) Posting Liability
    (4) Check Writing
b. Applying Distributions
    (1) Allocating Expenses
    (2) Analysis of Records
c. Accounting Controls
    (1) Accounts Payable Control Sheet
    (2) Invoice Register
    (3) Cash Disbursement Register
    (4) Trial Balance

Unit 80 Application Study 3 - Accounts Receivable

a. Functions
    (1) Establishing Accounts
    (2) Recording Transactions
    (3) Credit Screening
    (4) Customer Statements
    (5) Late Accounts
b. Typical Procedures
    (1) Open Item
    (2) Balance Forward
c. Accounting Control
d. Aged Trial Balances
e. Dating
f. History and Reference Information
g. Approach Study 1. Retail A.R.
h. Approach Study 2. Public Utility A.R.
j. Approach Study 3. Loan Accounting

Unit 81 Application Study 4 - General Ledger and Financial Control

a. General Ledger Accounting
   (1) Chart of Accounts
   (2) Account Coding
   (3) Source Records
   (4) Trial Balance
   (5) Income Statement
   (6) Balance Sheet
   (7) General Ledger
b. Financial Control
   (1) Expense and Revenue
   (2) Budgets and Budgetary Control
c. Capital Stock Accounting

Unit 82 Application Study 5 - Inventory Control and Material Accounting

a. Indentification of Inventory
b. Physical Inventory
c. Concepts of Inventory Control
d. Balance Forward Approach
   (1) Balance Card
   (2) Issue Card
   (3) On-Order Card
   (4) Requirement Card
   (5) Receipt Card
   (6) Adjustment Card
   (7) Transaction Register
   (8) Stock Ledgers
   (9) Stock Status Summary
   (10) Inventory Control Flow Chart
e. Material Accounting
   (1) Credits to Inventory
   (2) Costing Issue Cards
      (a) Standard
      (b) Average
      (c) First In-First Out
      (d) Last In-First Out
      (e) Last Purchase Price
   (3) Producing Accounting Entries
   (4) Analysis Reports

Unit 83C Numbers Systems for Computers

a. Binary Number System
b. Octal Number System
c. Other Number Systems
d. Binary Coded Decimals
e. Binary Coded Decimal in 1401 Computer

f. Concept of Parity in 1401 B.C.D.
g. Concept and example of Modular Number Systems
h. Zoned Modular Numbers in 1401 B.C.D.

Unit 84C Introduction to Computer Programming

a. Uses of Computer
b. Types of Computer
c. Types of Input/Output devices
d. Divisions of Computer (Review)
e. Concept of Stored Program (Memory Layout)
f. Problem Analysis
g. Computer Languages (Introduction)

Unit 85C Flow Chart of Computer Program

Unit 86C S.P.S. Coding Sheet, 1401

Unit 87C Reserved Areas in 1401

Unit 88C Character Layout

a. Fixed and Variable Word Length
b. Word Marks
c. Record Marks
d. Symbolic Addresses & Labels

Unit 89C Elementary Commands/Operation Codes

a. Read
b. Punch
c. Write
d. Load
e. Set Word Mark
f. Clear Word Mark
g. Clear Storage
h. Move
i. Add
j. Halt

Unit 90C Writing Simple Programs

a. Flow Chart
b. Memory Layout
c. Card Layout

d. Coding
e. Running
f. Testing/Evaluating

Unit 91C Computer Operator Orientation

a. Card Handling
b. General Operating Concepts

Unit 92C Card Reader/Operation 1402

a. Speed
b. Card Feed and File Feed
c. Check Station (hole count)
d. Read and Check Station
   (1) Validity and Odd Bit Parity Checking
e. Stackers
   (1) Capacity
   (2) Stop Light
   (3) Empty While Running
   (4) NR, 1,2
f. Reader Light
   (1) Two cards not read or processed
g. Keys
   (1) On/Off
   (2) Non-process run out
   (3) Load
   (4) Check Reset
h. Lights
   (1) Power
   (2) Transport
   (3) Validity
   (4) Reader Check
   (5) Reader Stop

Unit 93C Card Punch Operation (1403)

a. Speed
b. Card Feed
c. Blank (or Optional Read) Station
d. Punch Station
e. Punch Check
f. Stacker Select
   (1) NP
   (2) 4
   (3) 8
   (4) Possibility of Merge
g. Card run out
h. Keys
   (1) On/Off

(2) Non-process run out
(3) Start, Stop, Check-Reset

i. Lights
(1) Fuse
(2) Chips
(3) Stacker
(4) Punch Check
(5) Punch Stop

Unit 94C Printer Operation, IBM 1403

a. Characteristics
(1) Speed
(2) Print Positions
(a) Standard 100
(b) Optional 32
(3) Characters

b. Form Control
(1) Review Tape Control
(2) Feed Clutch
(3) Paper Advance Knob
(4) Vertical Print Adjustment
(5) Lateral Print Vernier
(6) Print Density Control
(7) Print Timing Dial
(8) Print Unit Release
(9) Print Line Indicator and Ribbon Shield
(10) Horizontal Adjustment
(11) R. H. Vernier Adjustment
(12) Tractor Slide Bar

c. Keys
(1) Start & Stop
(2) Check Reset
(3) Carriage Space
(4) Carriage Restore
(5) Single Cycle
(6) Carriage Stop

d. Lights
(1) End of Form
(2) Forms Check
(3) Print Ready
(4) Print Check
(5) Synchronizer Check
(6) Indicator Panel
(a) Gate Interlock
(b) Brush Interlock
(c) Shift Interlock
(d) Thermal Interlock
(e) High/Low Speed Start
(f) High/Low Speed Stop

Unit 95C C.P.U. Operations (1401)

a. Control Keys and Switches
   (1) Power on/off
   (2) Emergency Off
   (3) Start
   (4) Stop
   (5) Start Reset
   (6) Check Reset
   (7) I/O Check Stop
b. Lights
   (1) Process
   (2) Ramac
   (3) Reader
   (4) Punch
   (5) Printer
   (6) Storage
   (7) A & B Character
   (8) Logic
      (a) O-Flo
      (b) B≠A
      (c) B=A
      (d) B>A
      (e) B<A
      (f) Bit Display
   (9) Register
      (a) Op
      (b) Instruction Length
      (c) Storage Address
c. Register Key Lights
   (1) I
   (2) A
   (3) B
   (4) A and B Auxiliary
d. Storage Address Dial Switches
e. Mode Switch
   (1) Run
   (2) I/EX
   (3) Single Cycle Process
   (4) Single Cycle Non-Process
   (5) Character Display
   (6) Storage Print Out
   (7) Alter
   (8) Storage Scan
   (9) Address Stop
f. Sense Switches
g. Auxiliary Console
   (1) Bit Switch
   (2) Enter
   (3) Check Stop
   (4) Auxiliary Model
      (a) Full Storage Print
      (b) Print Storage Scam
   (5) Disk Unit

Unit 96C Assembly Routine (Card Only) 1401

a. Pre-list
   (1) Need
   (2) Possibility of using 402 for same operation
b. Assembly Routine
c. Post List

Unit 97C Dumping

a. Dump Routine
b. Storage Print out

Unit 98C Console Error Sheet

Unit 99C Disc Operation and Controls (1311)

a. Basic Operations
b. Utility Routine, Call in From Disc

Unit 100C Programming Concepts†

a. Divisions and Basic Concepts of
   (1) Business
   (2) Scientific
b. Relationships of data
   (1) Character
   (2) Field
   (3) Record
   (4) File
c. Types of Computer Language
   (1) Machine
   (2) Procedure
      (a) General mnemonics (e.g. SPS, Autocoder)
      (b) Common e.g., COBOL, FORTRAN
      (c) Translator and Compilers
d. Memory Allocation and Reservations
   (1) Program
   (2) Data
   (3) Working
   (4) Input/Output
   (5) Other

† It is expected that much of this material will have been previously introduced in a general fashion. The instructor should bear in mind that all of these concepts are being presented at a high school level and excessive detail may not add considerably to the students' knowledge at this time.

(6) Decision Making
(7) Loops
(8) Subroutines
(9) Buffers
(10) Random and Sequential Access
(11) Chaining

Unit 101C The Branch Instruction, 1401

Unit 102

Unit 103C Overview of Computer Application

a. The computer as a tool in
(1) Management
(2) Accounting
(3) Industrial control
(4) Other applications

Unit 104C Symbolic Coding of Constants (1401)

a. Need for Constants
b. Labels and Symbolic Addressing
c. DCW
d. DC
e. DS
f. DSA

Unit 105C Processor Control Operations (1401)

a. Uses and advantages
b. ORG
c. CTL
d. EX
e. END

Unit 106C Condensing Programs (1401)

Unit 107C Commands/Operation Codes-Intermediate 1 (1401)

a. Add (address only)
b. Zero and Add
c. Subtract (A and A and B address)
d. Zero and Subtract (A, A & B address)
e. NOP
f. Move Character and Suppress Zero
g. Move Numerical
h. Move Zone

Unit 108C Commands/Operation Codes-Intermediate 2 (1401)

a. Compare
b. Branch If Indicator On
   (1) Results of Compare
   (2) Sense Switches
c. Branch If Character Equal
d. Branch If Word Mark and/or Zone

Unit 109C Editing (1401)

a. Control Characters
b. M.C.E.

Unit 110C Combined Instructions (1401)

a. Halt and Branch
b. Clear Storage and Branch
c. Punch and Branch
d. Write and Branch
e. Write Word Marks and Branch
f. Write and Read
g. Write, Read, and Branch
h. Read and Punch
i. Read, Punch, and Branch
j. Write and Punch
k. Write, Punch, and Branch
l. Write, Read, and Punch
m. Write, Read, Punch, and Branch

Unit 111C Document Control (1401)

a. Select Stacker
b. Select Stacker and Branch
c. Control Carriage
d. Control Carriage and Branch

Unit 112C Character Adjustment (1401)

Unit 113C Index Register (1401)

Unit 114C Address Modification (1401)

a. MA
b. Without Indexing Feature
c. With Index

Unit 115C Multiply Subroutine

Unit 116C Multiply Feature (1401)

Unit 117C Divide Subroutine

Unit 118C Divide Feature (1401)

Unit 119C Square Root Subroutine (1401)

Unit 120C Expanded Print Edit (1401)

a. Asterisk Protection
b. Floating Dollar Sign
c. Sign Control Left
d. Decimal Control

Unit 121C Rounding Results in Computer

Unit 122C Command/Operation Codes Advanced (1401)

a. Store A Register
b. Store B Register
c. Move Characters to Record or Group Mark

Unit 123C Disc Programming, Elementary (1311, 1401)

Unit 124C Concepts of Automatic Programming Language

a. Free Form Statement
b. Macro/Micro
c. Special Routines

Unit 125C Introduction to Autocoder (1401)

a. Advantages
b. Definition of
c. Coding Sheet

Unit 126C Autocoder Operands (1401)

Unit 127C Autocoder Literals (1401)

Unit 128C Autocoder Language (1401)

- a. Imperative Statements
- b. Declarative Statements
- c. Control Statements

Unit 129C Macro Statements (Autocoder) (1401)

Unit 130C Selected Practice Problems, Autocoder (1401)

Unit 131C Fortran Programming, Introduction

- a. Overview
- b. Statements Type
  - (1) Arithmetic
  - (2) Input/Output
  - (3) Flow of Control
  - (4) Procedure

Unit 132C Fortran Constants

- a. Numbers
  - (1) Integer
  - (2) Real

Unit 133C Fortran Variables

Unit 134C Fortran Operations and Expressions

- a. Addition
- b. Subtraction
- c. Multiplication
- d. Division
- e. Exponentiation

Unit 135C Fortran Mathematical functions

- a. Overview
- b. Examples

Unit 136C Fortran Arithmetic Assignment Statements

Unit 137C Fortran Input and Output

a. Read Statement
b. Format Statement
c. Write Statement

Unit 138C Other Fortran Statements

a. Pause
b. Stop
c. End
d. Call Exit
   (1) Monitors
   (2) Call Exit with Monitor

Unit 139C Writing, Punching & Running a Fortran Program

a. Statement Number
b. Comment Line
c. Continuation Card
d. Coding Forms

Unit 140C Case Study, #1, Fortran

a. Review equation for Area of triangle

$$\text{Area} = \sqrt{S\,(S-A)\,(S-B)\,(S-C)}$$

$$\text{where } S = \frac{A + B + C}{2}$$

b. Student write and run, Fortran
c. Student write and run above in Autocoder

Unit 141C Transfer of Control in Fortran

a. Overview
b. Go to Statement
c. Arithmetic If Statement
d. Computed Go to Statement
e. Logical If Statement

Unit 142C Case Study, #2, Fortran

a. Current in an AC Circuit

$$I = \frac{E}{\sqrt{R^2 + (2\,\Pi f L - \tfrac{1}{2}\,\Pi f C)^2}}$$

b. Student write and run, Fortran

Unit 143C Subscripted Variables

a. Introduction
b. Two dimensional array
c. Dimension Statement

Unit 144C Case Study, #3, Fortran - Linear Interpolation

a. Description of Problem
b. Student write and run, Fortran

Unit 145C DO Statement

a. Fundamentals & Definitions
b. Rules governing the use of DO

Unit 146C Case Study, #4, Fortran

a. Gaus-Seidel Method of Solving Simultaneous Equations
   (1) Description of Problem
   (2) Student write and run, Fortran

Unit 147C Operating Systems Survey

a. Need for
b. Examples of

Unit 148

Unit 149

Unit 150

Unit 151E Concept of Programming

Unit 152E Punched Card (IBM-80 Column)

a. Hollerith Code
b. Card Format
c. Deciphering Hollerith on the Punched Card
d. Concept of Field

Unit 153E Keypunch

a. General Information
b. Individual Demonstration and Practice

Unit 154E IBM 402 Accounting Machine - Part 1

a. The Wiring Diagram
b. Division of Typebars
c. Concept of Zones and Numbers (Two Read Stations)
d. Printing Numbers

Unit 155E IBM 402 Accounting Machine - Part 2

a. Alphabetic Printing
b. Offset Numeric Printing
c. Offset Alphabetic Printing

Unit 156E IBM 402 Accounting Machine - Part 3

a. Combined Alphabetical & Numerical Printing
b. Emitting through Digit Selector

Unit 157E Flowcharts and Block Diagrams

a. Concept of and uses
b. Basic Symbols
c. Student Flowcharts

Unit 158E IBM 082 Sorter - Part 1

a. Description and Operation
b. Numerical Sort

Unit 159E IBM 082 Sorter - Part 2

a. Alphabetic Sorting
b. Selecting

Unit 160E IBM 548 Interpreter

a. Description & Operation
b. Card Interpretation

Unit 161E IBM 402 Accounting Machine - Part 4

a. Concept of Counters
b. Adding on 402
c. Counting Cards on 402

Unit 162E IBM 514 Reproducing Punch - Part 1

a. Concept and Uses
b. Gangpunching

Unit 163E IBM 514 Reproducing Punch - Part 2

a. Reproducing - Straight
b. Reproducing - Offset

Unit 164E IBM 514 Reproducing Punch - Part 3

a. Combined Reproducing and Gangpunch

Unit 165E IBM 514 Reproducing Punch - Part 4

a. Demonstration of Mark Sensing
b. Gangpunch Emitter

Unit 166E IBM 085 Collator

a. Concept of and Uses
   (1) Match
   (2) Merge
   (3) Select
   (4) Sequence check

Unit 167E Computers - Part 1

a. Concept of and Uses
b. Demonstration of - IBM 1401
c. Sections of

Unit 168E Computers - Part 2

a. Languages
b. Operation

Unit 169E The Data Processing Field

a. Job Opportunities
   (1) Check Want Ads
   (2) Guest Speakers
b. Need for Specialized Education

Unit 170

Unit 171

Unit 172

Unit 173

Unit 174

Unit 175

Unit 176

Unit 177

Unit 178

Unit 179

Unit 180

Unit 181

Unit 182

Unit 183

Unit 184

Unit 185

Unit 186

Unit 187

Unit 188

Unit 189

Unit 190

Unit 191

Unit 192

Unit 193

Unit 194

Unit 195

Unit 196

Unit 197

Unit 198

Unit 199

Unit 200

Unit 201 IBM Keypunch - Advanced Techniques

a. Programming
   (1) Concept of and Uses
   (2) Program Drum
   (3) Program Card
   (4) Codes of Program Card
   (5) Using Program Card with Other Automatic Features
      (a) Automatic Skip
      (b) Automatic Duplication
      (c) Numeric Punching
      (d) Alphabetic Punching
   (6) Alternate Programming
b. Keyboard Locking
   (1) Causes
   (2) Clearing
c. IBM 024 - Introduction
d. IBM 029 - Introduction
e. Verifiers
   (1) Need for and Use
   (2) Operation
f. Changing Ribbon on Keypunch
g. Changing Fuses on Keypunch

Unit 202

Unit 203C Introduction to Cobal

a. Need for
b. Examples of
c. Advances and Changes in Language

Unit 204C Introduction to Tape Programming & Operation (1401)

a. General Information common to all Tape Systems
b. IBM 1401 Tape Format
c. Tape Commands
d. Tape Checking
e. Operator Tape Mounting

Unit 205C IOCS Programming

a. Advantages of
b. Uses of

Unit 206C Other Input/Output Configurations

a. Paper tape
b. Optical Scanning
c. Teleprocessing
d. Voice Answer Back
e. Etc.

Unit 207 Logic

(This unit is to be taught concurrently with the other Data Processing Units. No attempt should be made to correlate this material with computer techniques as such.

In the area of mathematical logic, minimal reference can be made to Boolean Algebra, Logic Circuits and their relation to computers and programming. This unit is an introductory Logic course.)

Rather, the importance of good organized thinking as related to the overall data processing field should be stressed. An overall systems concept can be worked in at this point. An overall outline and text is presently being developed for this unit.

Summary of Unit Schedule by Grade

Grade 9	Grade 10	Grade 11 Voc			Grade 11 Tech		Grade 12 Voc		Grade 12 Tech	
		TAB		Comp	TAB	Comp	TAB	Comp	TAB	Comp
151E	1G	201	72	83C	23	83C	58	91C	67	207
152E	2	23	73	a	24	84C	59	92C	69	124C
153E	3	24	74	d	25	85C	60	93C	70	125C
154E	4	25	75	e	26	86C	61	94C	72	126C
155E	5G	26	76	f	27	87C	62	95C	76	127C
156E	6	27	77	84C	28	88C	63G	95C	78	128C
157E	7	30		85C	29	89C	64	96C	208	129C
158E	8	28		86C	30	90C	65	97C	82*	205C
159E	9	29		87C	31	91C	66	98C	81*	147C
160E	10	31		88C	35	92C	67	99C		130C
161E	11	32		89C	36	93C	68	100C*		131C
162E	12C	33		90C	38	94C	69	101C*		132C
163E	13	34			39	95C	70	103C*		133C
164E	14	40			42	96C	71	104C*		134C
165E	15	35			47	97C	72	147C*		135C
166E	16	36			48	98C	73	207*		136C
167E	17	37			49	99C	74			137C
168E	18	38			50	100C	75			138C
169E	19	39			51	101C	76			139C
	20	41			52	103C	77			140C
	21*	42			53	104C	78			141C
	22*	43			54	105C	82			142C
		44			55	106C	208			143C
		45			56	107C	21			144C
		46			58	108C	22			145C
		47			59	109C	79*			146C
		48			60	120C	80*			206'
		49			61	110C	81*			203*
		50			62	111C				204*
		51			63G	112C				
		52			64	113C				
		53			65	114C				
		54				115C				
		55				116C				
		56				117C				
		57				118C				
		58				119C				
		59				121C				
		60				122C				
		61				123C				
		62								
		63G								
		64								
		65								
		66								
		67								
		68								
		69								
		70								
		71								

*Optional Units.
Use if Time Permits.

SELECTED BIBLIOGRAPHY

IBM Data Processing Application, Payroll & Accounting 1962
#E20-8037-0

Accounts Payable 1960
#E20-8030-0

Accounts Receivable 1961
#E20-8035

Inventory Control & Material Accounting 1961
#E20-8034-0

General Ledger and Financial Control
#20-8033

IBM Reference Manuals

Functional Wiring Principles	A24-1007-0
85 & 87 Collators	A24-1005-2
402, 403.4419 Accounting Machines	224-5654-13
513, 514 Reproducing Punches	A24-1002-2
82, 83 and 84 Sorters	A24-1034-1
1401 System Operation Reference Manual	A24-3067

Data Processing Harry P. Hartkemeier John Wiley, 1966

Fortran IV Programming - 1966 McGraw-Hill - New York
Robert S. Ledley

A Guide to Fortran IV Programming - 1965 John Wiley,
New York

All IBM publications can be ordered from:
IBM Technical Publications Department
White Plains, New York

Business Data Processing, Gilbert Kahn, Gregg Division - McGraw-Hill

Automation Office Practice--Nanous & Nanous, Southwestern Publishing Co.

AUDIO-VISUAL AIDS

It should be noted that, because of equipment changes and changing techniques, audio-visual materials tend to become dated rather rapidly. For this reason, rather than specify individual materials, recommended sources are listed.

Rutgers Vocational-Technical Curriculum Laboratory.

IBM - Your local IBM Representative will provide you with information as to available visual aids.

Data Processing Management Association, International Headquarters, 505 Busse Highway, Park Ridge, Illinois (D.P.M.A. publishes a booklet of various films for use in data processing. *It is highly recommended.*)

Education Services Press, 3M Company, Box 3100, St. Paul, Minnesota.

Other Computer Manufacturers - Check phone book for local representatives. They are usually more than happy to cooperate with local schools.